CLAIMS

We claim

1. A method for creating a dictionary for video compression, comprising

   (a) designating an initial reference dictionary of functions,

   (b) designating a set of video sequences to be used as training sequences,

   (c) calculating the motion residual image for at least one of the frames of a video sequence from the set of video sequences,

   (d) determining an energy threshold for evaluating the residual image,

   (e) evaluating the residual image for portions above the energy threshold

   (f) comparing a first high energy portion of the residual image to at least one function in the reference dictionary,

   (g) extracting the first high energy portion of the residual image,

   (i) storing the extracted high energy portion of the residual image,

   (j) synthesizing the dictionary from the stored high energy portion of the residual image.

2. The method of claim 1, in which the initial reference dictionary is a Gabor set.

3. The method of claim 1, in which the step of comparing comprises an inner product calculation.

4. The method of claim 1, further comprising the steps of

   (k) revising the residual image, and

   (l) repeating steps (f) - (i) for at least a second high energy portion of the residual image, after said first high energy portion has been extracted.

5. The method of claim 1 or 4, in which the step of synthesizing comprises

dividing the extracted high energy portions into at least two subsets based on an inner product calculation, and

calculating an updated dictionary pattern from the elements in the two subsets.

6. The method of claim 5, in which the step of calculating comprises

$$\hat{\mathbf{x}}_{j,n+1} = \frac{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(+)}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(+)}} \omega_i} - \frac{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(-)}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(-)}} \omega_i}$$

7. The method of claim 4, in which the initial reference dictionary and extracted portions of the residual image are rectangular images

8. The method of claim 7, in which the modified set of dictionary images are rectangular images of with a plurality of dimensions.

9. The method of claim 4, comprising the additional steps of

evaluating a histogram of usage of the synthesized dictionary functions, and

pruning the set of synthesized dictionary functions to retain only the most frequently used elements.

10. The method of claim 4 in which

partition size is constrained by a threshold function.

11. The method of claim 10, in which

the partition size threshold function decreases for successive iterations.

12. A dictionary for use in video compression, said dictionary generated by

(a) designating an initial reference dictionary of functions,

(b) designating a set of video sequences to be used as training sequences,

(c) calculating the motion residual image for at least one of the frames of a video sequence from the set of video sequences,

(d) determining an energy threshold for evaluating the residual image,

(e) evaluating the residual image for portions above the energy threshold

(f) comparing a first high energy portion of the residual image to at least one function in the reference dictionary,

(g) extracting the first high energy portion of the residual image,

(i) storing the extracted high energy portion of the residual image,

(j) synthesis from the stored high energy portion of the residual image.

13. The method of claim 12, in which the step of comparing comprises an inner product calculation.

14. The method of claim 12, further comprising the steps of

(k) revising the residual image, and

(l) repeating steps (f) - (i) for at least a second high energy portion of the residual image, after said first high energy portion has been extracted.

15. The method of claim 12 or 14, in which the step of synthesizing comprises

dividing the extracted high energy portions into at least two subsets based on an inner product calculation, and

calculating an updated dictionary pattern from the elements in the two subsets.

16. The method of claim 15, in which the step of calculating comprises

$$\hat{\mathbf{x}}_{j,n+1} = \frac{\sum_{\mathbf{x}_i \in S_{j,n}^{(+)}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in S_{j,n}^{(+)}} \omega_i} - \frac{\sum_{\mathbf{x}_i \in S_{j,n}^{(-)}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in S_{j,n}^{(-)}} \omega_i}$$

17. The method of claim 14, in which the initial reference dictionary and extracted portions of the residual image are rectangular images

18. The method of claim 17, in which the modified set of dictionary images are rectangular images of with a plurality of dimensions.

19. The method of claim 14, comprising the additional steps of

evaluating a histogram of usage of the synthesized dictionary functions, and

pruning the set of synthesized dictionary functions to retain only the most frequently used elements.

20. A video encoding system containing a dictionary generated by

(a) designating an initial reference dictionary of functions,

(b) designating a set of video sequences to be used as training sequences,

(c) calculating the motion residual image for at least one of the frames of a video sequence from the set of video sequences,

(d) determining an energy threshold for evaluating the residual image,

(e) evaluating the residual image for portions above the energy threshold

(f) comparing a first high energy portion of the residual image to at least one function in the reference dictionary,

(g) extracting the first high energy portion of the residual image,

(i) storing the extracted high energy portion of the residual image,

(j) synthesis from the stored high energy portion of the residual image.

21. The method of claim 20, in which the step of comparing comprises an inner product calculation.

22. The method of claim 20, further comprising the steps of

(k) revising the residual image, and

(l) repeating steps (f) - (i) for at least a second high energy portion of the residual image, after said first high energy portion has been extracted.

23. The method of claim 20 or 22, in which the step of synthesizing comprises dividing the extracted high energy portions into at least two subsets based on an inner product calculation, and

calculating an updated dictionary pattern from the elements in the two subsets.

24. The method of claim 23, in which the step of calculating comprises

$$\hat{\mathbf{x}}_{j,n+1} = \frac{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(+)}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(+)}} \omega_i} - \frac{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(-)}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in \mathbf{S}_{j,n}^{(-)}} \omega_i}$$

25. The method of claim 22, in which the initial reference dictionary and extracted portions of the residual image are rectangular images

26. The method of claim 26, in which the modified set of dictionary images are rectangular images of with a plurality of dimensions.

27. The method of claim 22, comprising the additional steps of

evaluating a histogram of usage of the synthesized dictionary functions, and

pruning the set of synthesized dictionary functions to retain only the most frequently used elements.

28. A machine readable medium, upon which are stored instructions to generate a dictionary for video compression according to the method comprising steps of

(a) designating an initial reference dictionary of functions,

(b) designating a set of video sequences to be used as training sequences,

(c) calculating the motion residual image for at least one of the frames of a video sequence from the set of video sequences,

(d) determining an energy threshold for evaluating the residual image,

(e) evaluating the residual image for portions above the energy threshold

(f) comparing a first high energy portion of the residual image to at least one function in the reference dictionary,

(g) extracting the first high energy portion of the residual image,

(i) storing the extracted high energy portion of the residual image,

(j) synthesis from the stored high energy portion of the residual image.

29. The method of claim 28, in which the step of comparing comprises an inner product calculation.

30. The method of claim 28, further comprising the steps of

(k) revising the residual image, and

(l) repeating steps (f) - (i) for at least a second high energy portion of the residual image, after said first high energy portion has been extracted.

31. The method of claim 28 or 30, in which the step of synthesizing comprises dividing the extracted high energy portions into at least two subsets based on an inner product calculation, and

calculating an updated dictionary pattern from the elements in the two subsets.

32. The method of claim 31, in which the step of calculating comprises

$$\hat{\mathbf{x}}_{j,n+1} = \frac{\sum_{\mathbf{x}_i \in S^{(+)}_{j,n}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in S^{(+)}_{j,n}} \omega_i} - \frac{\sum_{\mathbf{x}_i \in S^{(-)}_{j,n}} \omega_i \mathbf{x}_i}{\sum_{\mathbf{x}_i \in S^{(-)}_{j,n}} \omega_i}$$

33. The method of claim 33, in which the initial reference dictionary and extracted portions of the residual image are rectangular images

34. The method of claim 34, in which the modified set of dictionary images are rectangular images of with a plurality of dimensions.

35. The method of claim 30, comprising the additional steps of evaluating a histogram of usage of the synthesized dictionary functions, and pruning the set of synthesized dictionary functions to retain only the most frequently used elements.